

2827



Docket No.: M4065.0226/P226  
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:  
Tongbi Jiang

Application No.: 09/484,437 ✓

Group Art Unit: 2827

Filed: January 18, 2000 ✓

Examiner: J. Mitchell

For: DIE ATTACH CURING METHOD FOR  
BGA PRODUCT

#14/C  
Hondt  
J. Mitchell  
10/1/02

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AMENDMENT

Box Non-Fee Amendment  
Commissioner for Patents  
Washington, DC 20231

Dear Sir:

In response to the Office Action dated May 21, 2002, please amend the above-identified U.S. Patent application as follows:

In the Claims

Please amend claims 1 and 12 to read as follows:

1. (Amended) A semiconductor device comprising:

a solder mask;

a die; and

an adhesive layer between said die and said solder mask, wherein said adhesive

layer remains voidless after outgassing from said solder mask and is at least partially curable

at a temperature below about 100°C.

12. (Amended) , A semiconductor device comprising:

a solder mask;

a die;

C<sup>2</sup> electrical contacts in said solder mask and on said die, each said contact on said die being wire bonded to a respective said contact in said mask, said electrical contacts

being devoid of contamination caused by outgassing from said solder mask; and

an adhesive layer affixing said die to said solder mask, said adhesive layer being curable at a temperature below about 100°C and at a temperature between about 20°C and about 50°C higher than a glassy temperature of said adhesive layer.

#### REMARKS

Claims 1 and 12 have been amended for clarity and not for prior art reasons. Claims 1-20, 31 and 32 are pending in the present application.

Claims 1-20, 31, and 32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicant's admitted prior art (APA) in view of U.S. Pat. No. 6,034,194 to Dershem et al. Applicant respectfully traverses the rejection.

The present invention, as recited in amended claim 1, is a semiconductor device that includes “a solder mask; a die; and an adhesive layer between said die and said solder mask, wherein said adhesive layer remains voidless after outgassing from said solder mask and is at least partially curable at a temperature below about 100°C”.

In contrast to the invention recited in amended claim 1, the APA discloses a die adhered to a solder mask by an adhesive that does not remain voidless after outgassing from the solder mask. Thus, APA does not anticipate or render obvious the present invention as recited in amended claim 1.

Dershem et al. does not cure the deficiencies of the APA. Dershem et al. discloses securing an assembly of a die adhered directly to a substrate with a conductive "die attach paste." See col. 6, lines 35-41 of Dershem et al. Dershem et al. does not disclose or suggest a die adhered to a solder mask, as recited in claim 1.

Claim 1, and its dependent claims 2-11 and 31, are submitted as being patentable over the cited prior art.

The invention as recited in amended claim 12 is a semiconductor device including "a solder mask; a die; and electrical contacts in said solder mask and said die, each said contact on said die being wire bonded to a respective said contact in said mask, said electrical contacts being devoid of contamination caused by outgassing from said solder mask; and an adhesive layer affixing said die to said solder mask, said adhesive layer being curable at a temperature below about 100°C and at a temperature between about 20°C and about 50°C higher than a glassy temperature of said adhesive layer". As noted above in connection with the rejection of claim 1, Dershem et al. does not disclose a semiconductor assembly having a die adhered to a solder mask. Consequently, Dershem et al. does not anticipate or render obvious the present invention as recited in amended claim 12. Claim 12, and its dependent claims 13-20 and 32 are submitted as being patentable over the cited prior art.

The Office action appears to misinterpret portions of the present application, particularly those that relate to outgassing from the solder mask. For example, paragraph 7 of the Office action states that Dershem et al. discloses an adhesive that is free from voiding, and refers to col. 11, lines 53-54. Applicant notes, however, that this is inapposite to the present claims. The adhesive disclosed in Dershem et al. is, itself, non-voiding, as shown by tests performed on glass slides. See col. 11, lines 51-54. Dershem et al. is not concerned with solder mask outgassing. Claim 1, on the other hand, recites, in part, an adhesive layer which remains voidless after outgassing from the solder mask. Claim 12, recites, in part, electrical contacts which are devoid of contamination caused by outgassing

from the solder mask. Thus, the present invention relates to adhesive layers that are immune from the effects of outgassing in from the solder mask.

The apparent misinterpretation carries over to the rejection of claims 11 and 20, set forth in paragraph 10 of the Office action, where Applicant is said to admit that the adhesive produces outgasses that contaminate the contacts. On the contrary, as noted above, the outgasses discussed in the specification and recited by the claims in the present application are those produced from the solder mask, during curing of the adhesive for example, not outgasses that might be produced by the adhesive itself.

In addition, since solder masks are well known to be insulating, the assembly disclosed by Dershem et al. of a die adhered directly to a substrate with a conductive die attach paste does not suggest the present invention of a die adhered to a solder mask, with an adhesive that remains void free after outgassing from the solder mask.

Given that Dershem et al. does not disclose a semiconductor device having a solder mask, there is no teaching or suggestion of semiconductor devices having “a solder mask; a die; and an adhesive layer between said die and said solder mask, wherein said adhesive layer remains voidless after outgassing from said solder mask and is at least partially curable at a temperature below about 100°C” as recited in amended claim 1. Similarly, there is no teaching or suggestion in Dershem et al. of a semiconductor device including “a solder mask; a die; and electrical contacts in said solder mask and said die, each said contact on said die being wire bonded to a respective said contact in said mask, said electrical contacts being devoid of contamination caused by outgassing from said solder mask; and an adhesive layer affixing said die to said solder mask, said adhesive layer being curable at a temperature below about 100°C and at a temperature between about 20°C and about 50°C higher than a glassy temperature of said adhesive layer” as recited in amended claim 12 of the present application. For these reasons as well, independent claims 1 and 12, and their respective dependent claims 2-11 and 31, and 13-20 and 32, are submitted as being patentable over the cited prior art.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned “Version with markings to show changes made.”

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

Dated: August 20, 2002

Respectfully submitted,

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